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Journal of the Society of Arts.

FRIDAY, JUNE 24, 1859.

FINANCIAL STATEMENT.

The following Statement is published in this week's *Journal*, in accordance with Sec. 42 of the Society's Bye Laws, which provides that at the Annual General Meeting "the Council shall render to the Society a full account of all their proceedings, and of the Receipts, Payments, and Expenditure during the past year; and a copy of such Statement shall be published in the *Journal* of the Society on the Friday before such General Meeting."

ANNUAL STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING 31ST MAY, 1859.

Dr.

	£ s. d.	£ s. d.	£ s. d.
To Subscriptions for the year ending 31st May, 1859:—			
From Subscriptions			3502 0 8
Outstanding		1440 17 0	
Due on former years	563 4 0		
Estimated not recoverable	175 10 7	738 14 7	
available arrear of the year		702 2 5	
Life Contributions			225 15 0
To Dividends on Stock:—			
£5136 3s. 10d. Consols		150 17 6	
£ 388 1s. 4d. New 3 Per Cent		11 8 0	
			162 5 6
To Interest on Deposit Accounts			5 9 10
Legacy by Mr. Richard Horsman Solly		100 0 0	
Less 10 Per Cent. Duty		10 0 0	
			90 0 0
To Mr. T. Twining, Junr., in aid of the Working Classes Museum		300 0 0	
Balance of Subscriptions to H.R.H., the Prince Consort's Speeches		6 1 11	
Outstanding £29 7 7			
Sale of Microscopes		3 13 6	
Do. Catalogue of the Exhibition of Inventions		10 0 0	
Do. Pamphlets		4 13 3	
Repairs to Photographic Collection		2 3 6	
Sundries		2 4 10	
			328 17 0
To Special Subscriptions held in Trust:—			
Balance of Examination Prize Fund, at London and Westminster Bank		85 15 4	
Subscriptions to the Fund, received 31st May		133 6 8	
Do. do. outstanding £20 15s.			
Marine Algæ Prize		70 0 0	
Donations:—To be awarded as a Prize for the best Writing Case for Soldiers, Sailors, Emigrants, &c.			
By Mr. John MacGregor		10 0 0	
By the Rev. F. Trench		10 0 0	
			20 0 0
			£4334 8 0

Cr.

	£ s. d.	£ s. d.	£ s. d.
By General Establishment Expenses:—			
Rent, Rates, and Taxes		184 16 11	
Insurance, Gas, Coals, and House Charges		132 13 11	
Salaries, Wages, and Commissions		940 15 8	
Postage, Stamps, and Carriage of Parcels		110 16 11	
Stationery and Printing (not including Journal)		150 16 4	
Advertisisements		12 14 0	
			1532 13 9
By Special objects:—			
Working Classes Museum		211 7 2	
Examination Prizes (estimated at £224):			
Writing Case Prize		20 9 6	
Swiney Prize		207 11 6	
Gutta Percha Committee		12 10 11	
Sundries		0 14 0	
			452 13 1
By Ordinary Expenditure:—			
Journal, including Contract for Composition, Printing, Paper, Stamps, and Delivery £821 16 10			
Less charged to Union of Institutions £164 7 4			
		657 9 6	
Union of Institutions, including proportion of Journal, Examinations, List of Lecturers, Postage, Stationery, Printing, and other charges		614 4 11	
Exhibition of 1861		178 13 9	
Exhibition of Inventions		127 18 8	
Medals		18 9 0	
Two Conversazioni		164 14 11	
Library		57 11 1	
Artistic Copyright Committee		12 4 3	
Surgical Instrument do.		4 5 6	
Colonial do.		1 5 0	
Small Parcels Post do.		4 13 6	
Repairs and Alterations		42 16 3	
Dinner		25 9 0	
Sundries		0 13 6	
			1910 8 10
			3895 15 8
By Excess of Income over Expenditure			438 12 4
			£4334 8 0

BALANCE SHEET, 31ST MAY, 1859.

Dr.

	£ s. d.	£ s. d.	£ s. d.
To Sundry Creditors, viz.:—			
To Tradesmen's Bills		519 1 7	
Fees to Examiners		129 3 0	
Salaries and Commissions		24 0 8	
			672 5 3
To Working Classes Museum			213 11 2
Gutta Percha Committee			47 9 1
Writing Case Prize		20 0 0	
Marine Algæ ditto		70 0 0	
Examination Prize Fund		219 2 0	
Outstanding £20 15s. 0d.			
To Trust Liability in respect of Government Stock (Consols) held for specific purposes, as per contra, set apart to answer:—			
Swiney Prize		1333 6 8	
Stock Trust		100 0 0	
To Government Stock New 3 per Cent., set apart to answer Fothergill Trust		388 1 4	
			£ 933 5 6
By Excess of Assets over Liabilities			4053 18 8
			£4987 4 2

Cr.

	£ s. d.	£ s. d.	£ s. d.
By Cash in hand:—			
At Messrs. Coutts and Co.		211 12 11	
At Commercial Bank		241 1 3	
			452 14 2
At the London and Westminster Bank, applicable to specific purposes		309 2 0	
By Consols, £3702 17s. 2d., at 93			3143 13 0
By Subscriptions in arrear		1440 17 0	
Estimated as not recoverable on the gross amount outstanding		350 0 0	
			1090 17 0
By Government Stock held in trust applicable to specific purposes, viz.:—			
Consols		1433 6 8	
New 3 per Cents.		388 1 4	
			£4987 4 2

(Signed) J. GEORGE APPOLD, SAM. REDGRAVE, } Auditors.
P. LE NEVE FOSTER, Secretary.

EIGHTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Eighth Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on TUESDAY next, the 28th inst. at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, immediately, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairmen of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference.

ANNUAL DINNER.

The One hundred and fifth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on TUESDAY next, the 28th inst., at half-past six for seven o'clock precisely. Members and their friends are requested to take notice that tickets (price 10s. 6d. each) may be had at the Society's House, on and after Monday, the 13th instant. The Right Hon. Lord Napier will preside.

ANNUAL GENERAL MEETING.

The one hundred and fifth Annual General Meeting, for the purpose of receiving the Council's Report, and the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, will be held on Wednesday next, the 29th inst., at four o'clock, p.m.

The Balloting List, prepared by the Council in accordance with Sec. 101 of the Bye Laws, is issued to each Member with this week's *Journal*.

The Council hereby convene a Special Meeting of the members of this Society, for the purpose of electing gentlemen proposed as members, such meeting to take place at the close of the Annual General Meeting, to be held on Wednesday next, the 29th inst.

By order of the Council,
P. LE NEVE FOSTER,
Secretary.

22nd June, 1859.

NOTICE TO INSTITUTIONS.

The New Edition of the List of Lecturers, including information relative to Apparatus and Diagrams for Class Instruction, has been prepared, in accordance with the wish of the Institutions, as expressed at the Conference last year, and a copy has been sent to each Institution in Union, with this week's *Journal*.

OPENING OF GALLERIES OF ART IN THE EVENING.

The following letter has been addressed to the Secretary of the Trustees of the National Gallery by the Hon. Secretaries of the Yorkshire Union of Mechanics' Institutes :—

"SIR,—As representatives of nearly 100 Mechanics' Institutes comprised in the Yorkshire Union, we most respectfully appeal to the Trustees of the National Gallery, that the Turner and Vernon collections of paintings and drawings, in common with all national collections of Fine Arts, may be open for exhibition to the public of an evening as well as by daylight.

"We are induced to trouble you with this request, as the Chancellor of the Exchequer has stated in the House of Commons that the Turner and Vernon collections are to be exhibited in the new galleries connected with the museum at South Kensington, and no provision having as yet been made for artificial light, it is apprehended that the Trustees intend the Exhibition to be limited to the hours of daylight.

"It must be unnecessary to offer any argument to show the interest which is taken by the public at large, more especially the industrious classes, in the valuable collections in Museums and Galleries of Art, and the importance of allowing access to them at times convenient to those who are engaged in business throughout the day. In Yorkshire, the great success which has attended the establishment of local Schools of Art, proves abundantly the appreciation of the beautiful by even the humblest in social rank; and as those who are engaged in industrial occupations are by far the great majority of the population, this exclusion from national collections, by the exhibition being confined to hours of daylight, would be considered a great deprivation.

"As we have every reason to believe that the Trustees of the National Gallery are desirous that the valuable collections under their charge should be seen by the public as freely as possible, and as the experience already gained of evening exhibitions has proved that they are visited by large numbers of people whose orderly conduct is unquestionable, we entertain the hope that the Trustees will, in every case where practicable, allow the National Collections of the Fine Arts to be open to the public for exhibition of an evening.

"We have the honour to be, Sir, yours respectfully,
"JAMES HOLE, } Hon. Secs."
"JAMES KITSON, Jun., }

MANUFACTURES, PROPERTIES, AND APPLICATION OF WATER GLASS, INCLUDING A PROCESS OF STEREOCHROMIC PAINTING.

BY DR. JOHANN NEP. FUCHS.

(Translated by desire of and communicated by H.R.H. the Prince Consort, President of the Society of Arts.)

[CONCLUDED FROM PAGE 526.]

SECTION II.

SPECIAL APPLICATION OF THE WATER GLASS.

The applications which water-glass has found are based upon its properties, as illustrated in Section I. By paying due regard to these properties, no serious difficulties will be met with in its special applications.

One of the most important applications of water-glass is, no doubt, that for painting, based upon its property of causing colours to adhere well, and of imparting to paintings, as well as to coats of paint, great durability and indestructibility. I call this kind of painting *Stereochromy* (from στερεὸς solid, firm, and χρῶμα colour). It designates that method of painting in which

water-glass serves as the connecting medium between the colour and its substratum.

For *monumental painting* it rivals, and will eventually supersede fresco-painting. I am told that it has gained considerable ground in Prussia; that fresco-painting has in several cases been abandoned, and that mural paintings, which are in course of execution, are done by the stereochromic method. In England also this method is reported to receive great encouragement.

The so-called encaustic painting cannot be compared to it.*

At Munich, the metropolis of German art, it has not met with much favour, although first discovered at that place,—perhaps, *because* it was first discovered there.

Before I proceed to the application of water-glass in stereochromic painting, I should like to make a few more preliminary remarks.

I was first induced to investigate the soluble silicates by the many complaints which I heard in regard to fresco-paintings, especially as to their want of stability in our severe climate. I speculated as to whether colours could not be made to adhere better and more firmly upon the walls by means of water-glass than by means of lime. This led to experiments, which sometimes confirmed, sometimes negatived, the opinion I had conceived of its applicability. Many difficulties had to be overcome. Had I been able to paint myself, it would have saved me much unnecessary labour; for, owing to delays caused by submitting the various water-glasses to the judgment of others, much valuable time was lost, so that five years were spent over a great number of experiments, —expensive, though for the most part unsuccessful,— until I arrived at the desired end by the aid of Herr von Kaulbach's unceasing co-operation, and the lively interest shown by him in the new discovery.

It appears strange, indeed, that so much time and labour should have been occupied upon a discovery which in reality is so very simple, as will be seen by the following description.

It was found in the course of this investigation that stereochromy can be employed upon other substrata as well as upon walls, and that even easel pictures of moderate size can be advantageously executed; moreover, that stereochromic paintings and coatings of paint may be put upon certain grounds directly, *i. e.*, without a substratum of cement.

MURAL OR MONUMENTAL PAINTING UPON A GROUND OF MORTAR-CEMENT.

To produce a stereochromic picture of great beauty and permanence upon a wall, it is chiefly necessary to look to the *foundation* of the picture, which consists of a *lower* and an *upper* layer of mortar-cement. Errors which are committed in their preparation throw obstacles in the way of a painter and injure the beauty of the painting. The principal and most important operation in forming the ground-work, consists in imparting to the mortar-cement a thorough and stone-like solidity, and a perfect adhesion to the wall, at the same time rendering it capable of absorbing the water-glass in all its parts with equal avidity. The first layer or substratum is formed of ordinary lime-mortar; its object is to equalize the unevenness in the wall, and to cover well the stone. The sand ought to be of even grain, neither too coarse nor too fine, and it may be either calcareous or quartz-sand. It is, however, necessary to wash either kind well before using it. The lime must be properly slaked and sparingly employed, so as to render the cement—which must be made up with distilled or rain-water—rather poor than otherwise. A rich cement would not absorb the water-glass readily, and will sometimes cause it to crack.

The plaster covering thus prepared requires to be well dried, and exposed to the air for several days in order that it may absorb carbonic acid and be converted into basic carbonate of lime; for if the lime in this cement be perfectly caustic, the water-glass would subsequently be decomposed by it, and could not penetrate to the wall, —a matter of necessity if a good cementation is to be effected.

The saturation of the lime with carbonic acid may be accelerated by moistening the wall several times with a solution of carbonate of ammonia. When it is dry and the ammonia evaporated, water-glass may be employed to make it adhere to the wall. The application is repeated several times, allowing the surface to dry each time, and continued almost to the point of complete saturation. The water-glass used must be either the soda or the double water-glass, treated with as much liquor silicum as to render it perfectly clear.

Soda and double water-glass are preferable to potash water glass, because they are absorbed more easily; they ought not to be used in a concentrated state, but diluted with equal parts of water, in order to ensure their penetrating to the wall. The thickness of the plaster will be different in different places, owing to unevenness in in the wall; and since a thick layer requires more water-glass than a thin one, the latter will be saturated long before the other is, and it will be necessary to treat the thicker parts of the substratum separately with water-glass so long as it is absorbed, in order to render all parts equal.

When the lower ground has been thus prepared, the upper layer, which is to receive the picture, may be added soon after. To the careful preparation of this layer, I repeat it, the certainty of success, and the facility of the execution are mainly due.

The thickness of this upper layer is about $\frac{1}{10}$ of an inch. In its composition it does not essentially differ from the lower one, and consists of lime mortar, which ought to be made with distilled or rain water and well-washed sand (calcareous or quartz-sand) of a grain which does not exceed a certain size, and with not too much lime to prevent cracks and ensure complete absorption. It is better to run the sand through a sieve in order to obtain the right grain.

I am of opinion that artificially prepared calcareous sand, *i.e.* sand obtained by grinding marble or dolomite, is preferable to the natural sand, because the latter consists of round, smooth little grains, which do not set so well as the sharp-edged fresh grains of artificial sand. Very fine powder, on the other hand, which would set still better, is to be avoided, and should be removed by decantation or by means of a fine sieve, because it renders the mass too compact and less absorbent.

The condition of the surface of the ground for painting is chiefly dependent upon the size of the grains of sand; the coarser the grain the rougher the ground. This is to a certain degree rather advantageous than otherwise in painting, provided that water-colours adhere sufficiently until the water-glass be added. The surface ought to feel to the touch like a rasp, as Kaulbach expresses it. A difference must also be made according as the pictures are to be viewed at a great or a short dis-

* The paintings excavated at Pompeii were formerly thought to be of an encaustic nature, and various efforts were made to imitate them, but without result, since they were, in fact, real frescoes, as was conclusively shown by Professor Schafhäutl (see 'Augsburger Allgem. Zeitung,' of January 6 and 7, 1845; 'Beilage,' p. 42, fol. 49; and Dingler's *Polytechnical Journal*, vol. xcv. p. 76.) Nevertheless endeavours have lately been made at Munich to carry out large and expensive paintings in a certain encaustic style. How great a retrograde step in monumental painting was this! The paintings brought to light at Pompeii cannot be preserved long, but gradually decay. In order to protect them, they have been impregnated with wax and brushed over with sandarac, which deprived them of much of their original beauty. Would it not have been better to impregnate them with water-glass, which, no doubt, would render them more durable without depriving them of their freshness? Carbonate of soda, with effloresces, might be wiped off with a wet sponge, after which the painting can be washed with distilled water without fear of injury.

tance; in the first case, the sand used may be much coarser than in the second.

When this coat of mortar has become dry, it is sometimes rubbed over with a sharp sandstone or iron straightedge, in order to remove the thin layer of carbonate of lime which has been formed during the process of drying, and which would prevent the water-glass from being absorbed—and also to impart the required roughness to the surface.

I cannot, however, approve of this method, and I think it far better to destroy the calcareous incrustation by means of a simple chemical reaction, viz., by dilute phosphoric acid (1 part of concentrated acid to 6 parts of water). The acid is brushed over the surface by means of a sponge or brush. Phosphate of lime is formed, which binds well with the water-glass, so that the plaster does not suffer in the least; whereas, if mechanical friction is resorted to, there is a risk of detaching small pieces, and leaving small cavities which have to be filled in again.

When the ground has been thus prepared and well dried, it is impregnated with water-glass, in order to give it sufficient consistency, and to cement it well together with the substratum. It is advantageous to employ for this purpose double water-glass clarified with liquor silicum, and diluted with its equal bulk of water. It will be found sufficient to repeat this operation twice, after allowing some time for drying. Too much water-glass would only tend to close up the pores, which would throw considerable obstacles in the way of the painter. If too much should have been used, either the whole layer of plaster must be removed, or the oversight may be made good by waiting some time, till the further contraction of the water-glass renders the ground again sufficiently porous, or by applying heat, which is best done by burning alcohol on it.

After the upper ground has been thus prepared, either by rubbing or by the action of phosphoric acid, and cemented with double water-glass to which a little liquor silicum has been added, in such a manner that the water-glass is equally spread over the whole service, exhibiting a good and even absorption everywhere, painting *may be*, but *need not be* immediately proceeded with. Delay will only increase the capacity of absorption which the ground already possesses.

The artist has to observe no further precautions, and the necessary practice will soon be acquired by painting a few easel-pieces on such ground.

Artists who should, nevertheless, doubt the efficiency of the water-glass, and who should hesitate to undertake a larger work, will meet with the best advice at the hands of Herr von Kaulbach and M. Echter, who, I am sure, will be pleased to give the desired explanations and assistance.

The colours are ground with pure water and used by the artist upon the prepared surface, taking care to moisten the wall frequently with pure water, in order to displace the air from the pores and to ensure more completely the adherence of the colours. This syringing with water must be done with moderation, and only as often as is necessary. Great care must be taken not to wet too much those parts which have been painted over, because, as M. Echter observed, the colours are liable to lose their freshness; it appears that the water washes the finest and least powerful particles of the colours up to the surface. This inconvenience is greatest in places which have to be painted over repeatedly, and have to be moistened each time. M. Echter, however, has found a remedy. He brushes away these fine particles of colour, after they have got dry and before the picture is fixed, with a very fine brush, and he thus restores the picture to its original freshness.

Nothing more remains now but to fix the colours properly, to which end the fixing water-glass is more specially employed. It suffices to dilute it with half its volume of water.

The colours which adhere but slightly do not allow of the brush being used; and it is necessary to besprinkle the painting with water-glass, in the form of a fine shower or mist, at first very carefully, so as not to displace the colours or to cause them to run one into another. Professor Schlotthauer, who has bestowed much time and labour upon stereochromic experiments, has invented a syringe for this purpose, which leaves nothing to be desired, and for which stereochromy is much indebted. The operation of alternate besprinkling and drying is continued until the colours adhere so firmly that they cannot be rubbed off with the finger. If white pocket-handkerchiefs, which are sometimes employed as tests, be smudged, it does not prove that the colours are not possessed of the desired durability, because rubbing with great force loosens grains of sand, the friction of which detaches parts of the colour that indirectly smudge the pocket-handkerchief. The same is experienced in fresco-painting.

Experiments made with regard to the durability and solidity of colours have shown, that whilst some are sufficiently fixed, others are more or less loose, and soil the finger. This refers more especially to the so-called meagre colours, like black. These require more water-glass, which is added by means of a fine brush. Baron Kaulbach told me, however, a short time ago, that this occurs now but very rarely, since it can easily be guarded against by properly mixing the colours.

This is a general outline of the method by which Director von Kaulbach, assisted by the excellent painter M. Echter, has executed four large stereochromic paintings in the new museum at Berlin; and they all, especially the last, meet with unqualified approbation among all impartial artists and lovers of the art as to the increased perfection in the technical execution, and they are generally acknowledged to be a real advance in the art of monumental painting.

Before proceeding further, I have to make a few additional remarks.

It was soon found that water-glass could not be employed in stereochromy as oil in oil-painting, *i. e.* the colours could not be ground with water-glass before applying them. A very dilute solution even rendered the brushes soon stiff, and caused the colours to harden on the pallet. It remains to be seen, however, whether water-glass is to be rejected in all cases as an admixture to colours. There is no doubt that such a mixture cannot be dispensed with when damaged pictures have to be renovated, or when pictures which have been fixed are to be painted over in some parts, in order to restore harmony between these and the other portions of the picture. I am therefore of opinion that it may render good service in painting as an addition to many colours, especially to the meagre ones. I am not speaking now of the usual potash water-glass, which is inapplicable; but of that which has had liquor silicum and water added to it, and which is used for the fixing of pictures.

When the brush begins to become somewhat stiff, it has only to be put into pure water, and after a short time it will again be found fit for use, whilst another may be employed in the mean time.

The brush must not be left exposed to the air before washing it, or else it would become quite stiff, and could no longer be softened in water.

The hardening of the colours on the pallet may easily be prevented by adding, from time to time, a drop of water by means of a dropping-glass. It is well not to put too much colour upon the pallet.

These must be considered as a few hints only upon this subject; the trial of its applicability, however, must be left entirely to the artist.

I might mention here that Kaulbach executed the first picture by means of dilute water-glass, to which I had added a little caustic potash, upon a broad tile covered with a layer of plaster prepared with powdered

marble, which served him as a ground for painting upon. The trial succeeded so well, that he felt at once strongly in favour of the new method of painting. This little picture exists still, and is well preserved, although it has been much knocked about; a second and larger picture, similarly executed and well-finished, was destroyed by an accident. Soon after he expressed a wish to obtain a more tractable admixture to his colours than mere water, and I gave him a paste-like mass, such as is obtained by precipitating a dilute solution of alum with water-glass, and adding a little of the well-washed precipitate to the colours. A few trials were made, which for the most part succeeded well—some very well; but this also was not found to answer sufficiently; he thought it too tedious and inconvenient, and he convinced himself that no admixture is required when the grounds are rough, and that the colours adhere sufficiently with water alone.

Formerly, when potash water-glass was used for fixing the colours, it was often found to dry unevenly and to give a dirty appearance to the pictures, particularly when more water-glass was used than was absolutely necessary for the fixation. The "fixing water-glass" above described, has the advantage of allowing more freedom to the operator without any risk of staining the picture. An excess will only help to make the plaster-coat more durable. Should the surface be so much saturated with water-glass that an additional layer remains unabsorbed for a whole minute, it is better to blot off the excess with blotting-paper, as it might dry into greyish-white spots; but even these have been known to disappear spontaneously after a little time.

The painting is finished when the colours are fixed. It is well to wash the picture with spirits of wine after the lapse of a few days in order to remove any dirt or dust, as well as a little alkali, which is set free; and at the end of a few more days it may be washed with pure water without any risk of damage to the colours or fear of injury from exposure to the rain. Spring-water, which is apt to deposit carbonate of lime, must not be used for washing.

If a painting is to be executed on the outside of a building, care must be taken not to expose it to a heavy rain before the colours are fixed, because an hour's exposure might destroy what required weeks to execute.

The finished picture, especially when it is exposed to the open air, ought to be carefully examined, in the course of a few months or a year, to ascertain whether it has acquired any power of absorption. If so, it is evident that more fixing water-glass is required to fill up the pores caused by the gradual contraction of the original layer of water-glass. Although a second fixing operation is not absolutely necessary, it will improve the picture, for the more silica can be added to a stereochromic painting, the firmer and more durable will it become. My advice is, therefore, not to neglect the after-fixing of these paintings, especially of those on the outside of buildings, wherever it is feasible.

In the preceding lines I have spoken of the preparation which a fresh wall requires in order to render it fit for receiving a stereochromic painting, and I have now to answer the inquiry, which has frequently been addressed to me, whether old walls which are already covered with a layer of plaster can be used for stereochromic painting; to which question I can only give a conditionally affirmative reply. If the plaster has been rubbed with a rough sandstone and well smoothed, and if it then absorbs the colours well and is well cemented to the stones of the wall, thoroughly dry and free from efflorescent salts, or if, as is said in common parlance, the wall is quite sound, there is no reason why it should not be used for painting with success, after it has been duly impregnated with water-glass. This is shown by the experiments which I made with Director von Zimmermann and the late Professor Krötz.

Our wish to try the execution of a stereochromic painting on the outside of an old building, on a wall which was much exposed to the action of the atmosphere, was met half way by M. Himbsel, who desired to have two images of Saints executed at his country-house on the Lake of Starnberg, built about twenty years previously. The walls were found sound, the plaster firmly adhering to the stones (of which we convinced ourselves by striking the wall with a small hammer), and at the same time so little porous that it did not exhibit sufficient power of absorption, even after rubbing it with a very rough sandstone. We employed, therefore, phosphoric acid, diluted with ten parts of water, which was brushed twice over the wall. When dry, the wall was not very absorbent, yet sufficiently so to enable Von Zimmerman to begin his paintings without delay. The two pictures were executed without any difficulty, and satisfactorily fixed. The fixing was repeated after the lapse of a year. They are now five years old, and have remained quite intact ever since. I shall have to speak once more of these pictures.

The success which accompanied this first experiment naturally led to the idea that, perhaps, fresco-paintings could be converted into stereochromic paintings by a judicious use of water glass, and thus rendered equally solid. I leave it undecided for the present, whether this could be done successfully, as I have not had an opportunity of trying experiments, although it must appear highly desirable to discover means of protecting fresco-paintings, which are still being executed in spite of the discovery of stereochromy.

For want of experience, I can only give my opinion as to what might be the best method of procedure.

The picture would first have to be washed with rain-water, slightly acidulated with pure vineger, by way of besprinkling, in order to remove dust and dirt, principally, however, in order to remove the thin coating of carbonate of lime which has formed upon the surface, covering the colours and preventing the absorption of the water-glass. The besprinkling is repeated with pure water in order to remove the acetate of lime which has formed, and which would interfere with the subsequent action of the water-glass. Stronger acid would discolour the ultramarine and turn the chrome-red to chrome-yellow, and therefore must be avoided. Careful manipulation is required, even with the dilute acetic acid; and slight brushing with a sponge, soaked in the dilute acid, might sometimes conveniently be substituted for the sprinkling; the acid must altogether be employed very sparingly, as the evolution of carbonic acid gas might otherwise loosen the colours and detach them from their underground. Nothing remains now to be done but to saturate the dry picture with fixing water-glass.

Our climate is, as is well known, not very favourable to fresco-painting. We have a proof of this in the deplorable state of a large and fine picture on the Isar gate at Munich, representing the Emperor Lewis, the Bavarian, after the battle of Ampfing, which was painted nearly twenty years ago, and which has already suffered so much that it is likely to be destroyed before long if it is not protected. And yet this picture is placed in a rather favourable situation, being painted on the east side of the gate, therefore not much exposed to bad weather, and sufficiently elevated to be protected from the moisture and saline matter of the soil.

And is there no guarding against the destruction of this work of art?

It is important to ascertain how far the decay has been allowed to go on,—whether it is superficial, or whether it goes to the very depth, whether fissures or cracks exist, and whether parts of the plaster have become detached. It must be left to the judgment of the renovator as to what course ought to be pursued with regard to the injured painting.

I can only say so much, that I know of no other remedy but the water-glass and the water-glass mortar; the

first to fix the colours and the ground, the latter to fill up cracks and cavities, which then have to be painted over again by the artist. Although the picture may not be restored to its original perfection, it would nevertheless be protected from further decay, and saved from final destruction.

Stereochromy is but a child of late birth and has yet to struggle for its existence, and it must not be supposed that it has already reached the highest degree of perfection. Once taken up by others, it will no doubt be improved, and promises many advantages which may have been overlooked.

The chief attention must be directed to the upper layer of plaster, or the painting ground; in this errors are easily committed, and have frequently been the source of failures.

I have therefore endeavoured to obtain a still better and surer method for preparing the painting ground, and I think I have succeeded in obtaining one which answers in every respect. I propose to prepare the upper coat of nothing but *water-glass cement, i. e.* a mortar in which the lime is replaced by water-glass. The sand to be mixed with it may either be powdered marble or dolomite,—or quartz-sand mixed with a little dry slaked lime. [The addition of a little lime or white of zinc may also be of advantage when marble or dolomite are used, as it ensures a more perfect and powerful combination with the water-glass]. The mixture must be very intimately made. As to the proper proportions, it suffices to state that so much water glass should be added as to give to the mass the consistency of ordinary mortar.

This cement is laid on equally thick over the first plaster coat, properly smoothed and allowed to dry. It possesses many considerable advantages over the lime mortar which is *subsequently* to be impregnated with water-glass. Its preparation is simple, and every experienced mason will easily render himself master of it; mistakes can scarcely be made, as the material once decided upon remains always the same. The water-glass is equally spread through the whole mass, so as to ensure equal cementation and silicatization, which can scarcely be obtained when the water-glass is added at a later stage. During the repeated moistening of the picture no lime will be drawn to the surface and disturb the colours, because no soluble lime is left in the mass; moreover, no encrustation of carbonate of lime will ever form, and no rubbing with a stone will be required to render the surface absorbent. Lastly, the water-glass is here in immediate contact with the lower substratum, and ensures perfect adhesion to the wall, whereas the other method always leaves it uncertain whether the water-glass will penetrate the upper layer entirely and evenly.

This cement, when dry, becomes as hard as stone. At first it exhibits little or no power of absorption, which is easily accounted for, because all the pores are filled up with water-glass. It acquires, however, this property in a satisfactory degree by exposure to the air for a few days, especially when the air is warm and dry; but loses considerably in solidity by the contraction of the water-glass, and it becomes necessary to saturate it once or twice with water-glass diluted with half its volume of water, in order to impart to it the proper consistency. This must be done cautiously, so as not to stop up the pores by employing too much water-glass, which would obstruct the painting considerably. [The burning of spirits of wine on the surface would no doubt remedy the evil.]

If carbonate of soda effloresces on the surface, it is a sign that the plaster has set well. The efflorescence can easily be removed by means of a wet sponge, and the ground will then be found harder than before. Painting may now be proceeded with in the usual way.

M. Echter is at present engaged upon executing an easel-piece on a layer of water-glass cement, and the work promises well. He uses a plate of burned potter's clay, 3 feet 4 inches high and 3 feet wide and half an inch thick. After saturating the plate with water-glass, a painting ground of one-tenth of an inch in thickness, consisting of water-glass cement, was laid on and well smoothed. Painting upon this ground proceeds so well, that M. Echter assures me he could not wish for a better one.

The water-glass cement employed for this plate was made of pulverized dolomite (from which the finest powder had been removed by means of a fine sieve), and a little dry slaked lime, to which water-glass was added, so as to produce a mass of the usual plaster consistency. When dry, the plate was once more thoroughly impregnated with water-glass diluted with its own volume of water,* &c.

Hydraulic lime has also been recommended as a suitable substratum for painting, because, with a little water-glass, it forms a mass of considerable hardness and great absorbing power, in which the lime sets sooner than in the hydraulic cement. According to the experiments of M. Feichtinger, one part of solid water-glass is sufficient for 15 parts of hydraulic lime; a larger amount would be rather injurious than otherwise. But since water-glass cement responds to every application to which it can possibly be put, and since we have it in our power to prepare it most successfully, I have abstained from experimenting further upon the hydraulic lime, especially as it seems to be difficult to obtain it of uniform composition, and the result will therefore always be doubtful. In my pamphlet "On Chalk and Cements," I have already mentioned the service which water-glass is capable of rendering to hydraulic cements.†

It has already been stated that stereochromy may be applied to a variety of substrata, and that even stereochromic easel pictures can be successfully executed. When moderately burned so as to ensure good absorption, plates of clay, vessels of potter's clay, stoves of clay, &c., after being sufficiently saturated with water-glass, can be painted upon directly or indirectly. It will, however, be well to give them first a slight coating of water-glass cement, which ensures more readily a flat and equally coarse surface, suitable for painting. Easel pieces of considerable size may be painted upon plates of clay. The only limit to their size is the difficulty of managing plates of great weight. The plates should not be thicker than three-fourths of an inch, and not too much burned, so that they may absorb well. Their surface should be flat, but not smooth. Frequent saturation with double water-glass, diluted with half its volume of water, imparts to them a solidity such as strong burning could not do. Should they lose their absorbing power by the addition of too much water-glass, they have only to be warmed for some time, *e.g.*, by burning spirits of wine on them.

If it is required immediately to paint upon such a ground, it is well to add a little fixing water-glass to the colours, especially to the meagre ones. The further treatment is self-evident. Objects made of burnt clay,

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* This picture has since been successfully finished, and is now in the possession of the King of Bavaria, and may be seen on a wall in the Royal Winter Garden. The artist has chosen for his subject the Madonna della Sedia, by Raphael.

† In page 49 of that pamphlet I said; "A very good method of protecting this or any other hydraulic cement from decay, and imparting to it considerable hardness, consists in the application of water-glass solution after the cement has slightly contracted. When the water-glass has been brushed over its surface, water has no longer any effect upon it. It becomes coated with a hard crust, behind which the lime and the cement quietly continue their mutual action. Small pieces put into a very dilute solution of water-glass became in two or three days so hard that they could no longer be scratched with the finger nail. The liquid, generally rendered cloudy by dissolved lime, remained perfectly clear. A method so inexpensive might, therefore, find more frequent application."

such as figures, ornaments, vases, goblets, &c., can likewise be painted, and would gain considerably in beauty and durability. Attention would, however, have to be paid to the quality of clay which is used for such vessels.

I would draw attention to an application which might be made of water-glass, viz., to impart to our stoves, which are generally made of burnt clay (Dutch-tiles), a more agreeable appearance, thus offering to art a means of embellishing our rooms, and awaking the sense for the beautiful.

In order to convince myself of its feasibility, I had a tile taken out of the stove in my laboratory, and a new one of the same clay put in, which was first sufficiently saturated with water-glass, and then painted with band-like streaks of various colours mixed with a little water-glass, and finally fixed.

After the stove had been heated several times, the colours began to loosen, and they had again to be fixed, and this fixing process had to be repeated several times.

It is evident that heat increases the contraction of the water-glass, and I should have done better by saturating the tile repeatedly with water-glass and heating it, in order to impart to it the greatest possible quantity of water-glass; and I would advise complete saturation in any fresh experiment which may be made. The colours stood very well for two winters, in spite of being daily exposed to a strong heat, and they adhered so firmly, that they could only be detached with great difficulty. The stoker, however, made an end to all further observations, by accidentally breaking the tile in pieces, upon which the colours are still preserved undimmed.

Herr von Dyk, Director of the Telegraphic Office at Munich, has shown that cast iron may successfully be painted stereochromically.

At the instance of Professor Pettenkoffer, he ordered the cast-iron stoves in his offices to be painted on the flat parts with so-called caput mortuum, and on the raised parts, such as frames and decorations, with zinc-white. The paint has stood well up to the present time. Herr von Dyk made the interesting observation, that if the colour is applied while the iron is cold, it falls off when the stove is heated, but that it adheres well if applied while the iron feels warm to the touch.

The cause of this difference lies, no doubt, in the pores of the iron being somewhat more open at a slightly raised temperature, the air being slightly rarefied or partly displaced, so that the water-glass penetrates better.

This leads me to draw particular attention to the temperature at which the fixing of the painting ground and of the stereochromic picture is performed, especially to the temperature which the water-glass itself possesses.

It is very important that the water-glass should soak in evenly and deeply, in order to ensure everywhere equal and strong cementation. For this reason, the water-glass ought to be diluted with water. Like other fluids, it is rendered much more liquid when heated—say to between 100° and 120°—and penetrates therefore more readily into any porous mass, by displacing more easily the air than it would do at the common temperature, and renders it much more suitable for fixing colours upon porous objects. This action of the heat will be the more perceptible if the objects themselves, as well as the water-glass, are slightly heated, so that with care and attention a solidity and durability may be obtained such as mosaic works only possess.

If a syringe be employed for fixing the water-glass, it is most conveniently warmed by plunging it into warm water. Mural surfaces, which have to be fixed with water-glass, are best heated by burning alcohol on them, which process, however, can only be resorted to when the colours, which adhere but loosely, have once been fixed with water-glass in the usual way.

The rooms in which the fixing process has to be carried on, ought evidently to be kept warm during this operation.

Plates of *lithographic limestone* may likewise be used as a ground for stereochromic pictures; the first trials in stereochromic painting were, in fact, confined to such stones. They require, however, to be coated with a thin layer of water-glass cement mixed with somewhat coarse sand in order to ensure the adhesion of the painting ground. When the cement is quite dry, the upper coat is put on, and painting may be proceeded with.

If the lithographic stone is treated with phosphoric acid, it takes the colours well which are mixed with water-glass; it is therefore probable that in that state they may serve for stereochromic painting without any further preparation.

There is no doubt that plates of clay-slate can be painted upon stereochromically, after having received the proper preparation. This material has the advantage over clay or limestone plates, that it is less brittle, and need not, therefore, be so thick. I have as yet made no experiment with it.* Porous sandstone and porous limestone, when well saturated with water-glass, must likewise furnish a good ground for stereochromic painting, either directly or indirectly; there is at least no reason why they should not.

No stereochromic painting has, as yet, been directly executed upon *wood*. The water-glass, mixed with colours, has, however, been successfully employed for staining wood. When wood has been properly saturated with water-glass, the water-glass cement adheres well to it, and upon a thin layer of this cement a picture might of course be executed. In many instances the method may prove very useful.

It remains doubtful at present, whether a transparent stereochromic painting can be executed upon glass. There is, however, no difficulty in painting indirectly upon glass, if ever it should be thought advantageous, since water-glass cement, upon which the painting would have to be done, binds exceedingly well with glass.

It would be very desirable to employ such a light and flexible material as *canvas* as a ground for stereochromic painting, because easel-pictures of some extent, such as altar-pieces, could then readily be painted. Several experiments have been made, which have not yet led to satisfactory results; they are, however, being continued.

I have to make a few more remarks with regard to the colours which may be employed in stereochromy. Their number is so great that the new kind of painting is not restricted in their use.

M. Ch. Buchner, manufacturer of chemical products at Munich (Karlstrasse, No. 40), constantly keeps a complete assortment of them in store. They are:—

1. Munich-white.
2. Munich-black.
3. Munich-brown.
4. Chrome-green.
5. Cobalt-green, light and dark.
6. Chrome-red.
7. Oxide of iron, bright red, reddish brown, violet and brown.
8. Cadmium-yellow,—light and dark.
9. Chrome-yellow.
10. Ultramarine.
11. Dark ochre,—the same burnt.
12. Flesh ochre.
13. Gold ochre,—do. burnt.
14. Terra di Siena.
15. Umber,—ditto burnt.

No organic colour, such as lake, is admissible, because it will sooner or later be found to fade. Vermilion must also be rejected, because, when exposed to the light, it darkens and ultimately turns black.

The colours ought to be ground as finely as possible, because they are rendered thereby more manageable and more adhesive. Chrome-red alone forms an exception, because long-continued grinding turns it yellow.

Cobalt-blue shows a brighter blue after fixing, and

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* Paintings upon stone plates can be placed in walls in such a manner as to make them appear to form part of the wall. Once well fitted in, they are ensured against all accidents, and yet may easily be removed when a change of residence becomes necessary.

light ochre becomes darker. These two colours cannot therefore be recommended for this kind of painting.

It must be remarked that the fixing process produces slight changes in *all* the colours of the painting, which appears afterwards of a somewhat darker or more sombre hue; but after some time this effect disappears again.

The colours ought to be as pure as possible; they ought especially not to contain anything which reacts upon the water-glass and produces a decomposition, or causes it to coagulate, such as gypsum or sulphuric acid, which are frequently met with in red oxide of iron (kolkothar, caput mortuum), and in yellow ochre.

I cannot close this article without saying a few words with regard to the peculiarities, the convenience and advantage which this method of painting promises in comparison with fresco-painting, and the so called *encaustic*.

Its peculiarity consists in an entirely new vehicle, differing from those employed in every other method of painting, so that stereochromy must be looked upon *as quite a new method of painting*. The excellence of this method depends on the substratum of the picture, which enables it to resist the action of every climate, as well as the destructive influences of smoke, acid vapours, quick changes of temperature, hail, &c., which would destroy frescoes. I have therefore called it *stereochromy*.

The new vehicle holds the painting ground and the colours, as it were, fused together, silicated or petrified, forming the material distinction of this kind of painting, and rendering it far superior to fresco-painting with its ordinary ground of lime-mortar.

The durability of fresco-paintings depends chiefly upon this mortar, even more than upon the skill of the painter, who is usually blamed when his work does not succeed, or lasts only a short time. The ruin of a fresco-painting is, in my opinion, always caused by errors committed in the preparation of the mortar; the only error almost which the painter can commit is the choice of colours which fade or become discoloured in the course of time. Cornelius, when executing the frescoes in the Glyptothek at Munich, met with several difficulties of this kind, and he was accused of not understanding fresco-painting. When I was called upon to report upon the case, I found that the plaster was rotten, and contained much sulphate of magnesia or bitter salt. I ordered this ground to be entirely removed and to be replaced by a new one, prepared with washed sand and distilled water. No further complaint was made, and the paintings have stood very well. Much depends also upon the lime used in the mortar. If slaked and kept moist for some time, it answers better than freshly slaked lime; if poor, it acts better than rich; lime containing magnesia, oxide of iron, or manganese, is better than pure lime.

Encaustic painting has two enemies; the mortar ground, and the organic materials used for painting, which are subjected to the natural laws of decay and decomposition.

In more southern countries, as in Italy, fresco-paintings withstand, no doubt, longer the ravages of time than in northern climates; they are, however, not quite exempt from destruction, as is proved by Raphael's frescoes in the Loggie of the Vatican, which are said to have suffered considerably; and it has been found necessary to take precautions to prevent the further spreading of the destructive action.

In order to test the advantages of stereochromy, proof plates were submitted to the roughest treatment; they were exposed for weeks to rain and frost; the ice which had formed upon them was allowed to thaw in a warm room, and this freezing and thawing process was repeated without in the slightest degree damaging the plates, whilst fresco-paintings treated in the same manner became quite friable and crumbled to pieces.

A small stereochromic picture was exposed, on the roof of the Royal Museum at Berlin near the chimney, to the action of wet and cold, smoke and soot, for a whole severe winter. When taken down in spring, it certainly looked as if it had been completely spoiled; but upon its being washed with spirits of wine, it was found to be as fresh as ever it had been. A small picture (two peacocks) on the west side of Herr von Kaulbach's atelier, close to the ground, has been preserved well, although the ground is thoroughly damp, and covered with shrubs in summer. It deserves to be noticed, that the damp and the efflorescence of the wall during this rather long period of time, had scarcely any damaging effect upon the picture.

A further proof of the durability of stereochromic paintings will be found in the two pictures on the country-house of M. Himbsel, on the Lake of Starnberg, to which I have already referred. They are now six years old, and are still as fresh and unchanged as if they had just come from the hand of the artist, in spite of storm and weather, which often sweeps from the west over the lake close by, and dashes the rain upon the walls with such force, that it runs down in streams, forming sometimes crusts of ice in winter.

Stereochromy offers considerable advantage to the artist; painting is quite in his power, as well as the material, whilst fresco-painting makes him a slave of the latter. He is enabled to interrupt his work and continue it again after a shorter or longer time; he can retouch his painting before fixing it, as often as he thinks it desirable. The finest colouring, the slightest touch of light and shade, the harmony of colours, and consequently the greatest perfection of a painting, are in his power.

Stereochromy possesses that advantage which fresco-painting also has over oil-painting, that the colours are not shining, and that the observer can get a full view of a picture in whatever position he may be.

I have given a description of the principles upon which stereochromy is based, and I cannot help remarking, in conclusion, that this one investigation has cost me more time and labour, together with considerable outlays and expenses, than most of my other investigations put together. Several of my friends could testify to the same many of them assisted me materially in my difficulties and I offer them my deep-felt gratitude at the conclusion of my labours. But, before all, I thank God, who graciously allowed his weak and aged servant to finish the preceding investigation of the water-glass, and its application, so far, that others may build upon the foundation I have laid.

To the Giver of all Good be thanks for all joys and sufferings experienced! May His blessing be upon the work!

"Omnia ad majorem Dei honorem et gloriam!"

Munich, Nov. 20, 1855.

[A continuation of the various other applications of the water-glass will soon follow.*]

WHAT SHOULD MECHANICAL WORKMEN BE TAUGHT?

On Saturday afternoon, the 4th of June, a lecture on this subject was delivered, at the South Kensington Museum, by Mr. J. Scott Russell, F.R.S. The following ab-

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* Death has put an end to the labours of the learned philosopher, and the reader will not see the promised continuation. Fuchs had a presentiment of his approaching death when he wrote the above concluding lines, and he, who never deceived others, and rarely himself, was not deceived in this presentiment. He died eighty-two years old, on the 5th of March, 1856. Two of his pupils and friends have shown what Fuchs did for his country and for science,—Prof. Dr. von Kobell, in a Commemorative Oration delivered on the 25th March, 1856, the anniversary of the foundation of the Royal Bavarian Academy of Science; and Prof. Dr. Kaiser, in a necrology, published in the March Number of the Journal of the Society of Arts and Manufacture of the kingdom of Bavaria.—Dr. M. PETTENKOFER.

stract of it is principally taken from the report in the *Builder*.

The lecturer commenced by observing that he had the honour of appearing before them in a somewhat unusual capacity, in consequence of a conversation which had taken place not long ago between one of that great establishment and himself on the subject of the education of the class of workmen to whom he (Mr. Russell) belonged. Mr. Cole had shown him some papers which he had prepared for the purpose of examining workmen as to the progress which they had made in the kind of education generally provided for them; and expressed to him what he (Mr. Russell) now expressed, that the education provided in this country for workmen was not that which was very directly calculated to render them good workmen. He did not mean to infer that education did not make us all the better and wiser,—at all events it put in our hands the means of acquiring knowledge, and therefore reading, writing, drawing, and accounting were good for the skilled workmen, and for every body else. It did not, however, consort with his experience, that the best reader and the best writer were always the most skilled workmen; on the contrary, the best man he ever knew could neither read, write, nor account, and yet he was a very admirable workman. As a large employer of skilled labour, he now asked whether there was any description of education which in their opinion would tend greatly to the increase of the skill, dexterity, ability, and success of the practical working mechanic. He maintained that there was, but that the mechanic did not get it. It was extremely difficult to give, but if the rising teachers of the next generation—if the institution in which they were then met—if the Government—really and earnestly cared about the mechanic, and wished to make him a good and skilled workman, and wished to keep the next generation of workmen where English workmen had ever been—namely, at the head of the workmen of Europe—he would show what it was their duty to do, and what ought to be done. If was, no doubt, difficult to accomplish; but, if they all pulled together, it could be done. It would want a good deal of money, large and wise views, and great energy and self-denial. Having said thus much of the difficulties of the undertaking, he would recommend them not to be disheartened, as, if a little seed were sown, a little agitation commenced, and a little ventilation given to the matter, the Government might be induced to do all that ought to be done. The matter, moreover, was a serious one, because the Governments of other countries were doing a great deal for the education of their practical mechanics, which we, as a nation, were not doing. He himself was obliged to get his very best draughtsmen and mechanics from foreign countries. He had men in his employment from Prussia, Germany, and Holland; and he was bound to say that, as far as preliminary education was concerned, although the workmen of foreign countries had not the skill obtained by the British workmen from practical experience, their scientific knowledge was greater, and that knowledge was telling so rapidly on the present generation of workmen, that we were now equalled (he would not say excelled) by the workmen of many countries upon whom we were inclined to look down a few years ago. He hoped they would clearly understand that he did not say anything against the education now given. On the contrary, he would say, "Continue to teach drawing, reading, writing, and accounting in the best manner you can; but if you have a class of young workmen coming forward to learn, think how you can turn the little time they can afford to give to the best advantage, so that you may raise them higher in the social scale and make them better workmen." In order to do this, it would be necessary to give them a higher class of education than they were ever taught before. They had already been taught arithmetic, and they could answer such questions as, "How many yards of ribbon at 3½d. can be bought for 30s.?" Now this was all very right and proper for shopmen and shopwomen, but would not do for mechanics. They were also taught geometry. They were taught the 16th, 17th, 18th, and 19th propositions of Euclid, but that description of knowledge was not of the slightest use to his workmen, or to anybody else. They were also taught mechanics and the law of the lever. That was right; but then mechanics and the law of the lever were not ordinarily taught in books in such a way as to be of practical use to the British workman. We did not go far enough; but the pupil teachers whom he addressed were not to blame. The persons to blame were their teachers. Two years was perhaps all the time that could be devoted to education, and six months were often devoted to as many books of Euclid, which were wasted for all practical purposes, unless, indeed, the student intended to become a professor. He would advise them to skip over the beginning, and devote the least possible time to Euclid—in fact, he would advise them to do a very heterodox thing—to cut off all the propositions but the useful ones. They might naturally exclaim: "Then, how little will be left." Very little, he admitted—but plane trigonometry would be left. Suppose, for instance, a man had but six months in which to learn. Six weeks might in that case be given to Euclid, and then trigonometry might be commenced, solid geometry might next follow, and that constituted the whole education of the workman. But that was precisely what he did not get in the present day. He would also teach within the six months conic sections, and afterwards the nature of curves, within the first, second, third, and fourth degrees. He was aware he might be met by the exclamation—"Oh! but we shall be teaching themmore than we ourselves understand:" but to this he would answer—"That is the fault of your education." Sir Isaac Newton discovered no less than 130 curves, and nine-tenths of them would be of great use to the mechanic, if he had them in two places—in his head and at his fingers'-ends. Having now got to teaching something which they did not know, and had not learned, the next thing they wanted was the assistance of the Government. Decent elementary text-books were wanted for the higher departments in mechanics, but there were many able men versed in the sciences; and what he wanted the Department of Science and Art and the Government to do was, to ask the four cleverest men in England to write, in the fewest possible English words, all that they knew (not all that they had read), or in fact so much of their brains as they carried about with them. If Government would but pay handsomely for these books, a set of treatises might be collected such as the world never saw before, and such as would be sufficient to teach any mechanic his business. They might, it was true, say, "But we do not know where to get these clever men." But he knew where they were to be got. There were three of the four present at that moment; and if the Government would but give them a thousand pounds a-piece for writing the books, he was sure they would write them. What he had said about geometry was true as to mathematics. Thirteen yards and a-half at 3½d. was not what was wanted. Of far more importance to the working man was the comprehension of the laws and relations of numbers, so as to enable the working man to think in figures about the immediate business before him. Having explained the manner in which mechanics might make reduced or enlarged models, and the relations and practical properties of numbers, the lecturer illustrated the value of a knowledge on these points by an anecdote. He remembered an instance in which a respectable working man sent in a tender for £12,500 for a very large piece of work. The tender appeared to be low, and he obtained the order, and got on some way with the work when he found he had made a trifling omission—he had forgot to multiply by *two*. His figures were all right, but in one place he forget his multiplication, and his whole calculations were wrong. He was of opinion that geometry ought to be taught by a large and comprehensive system. Professor Airy had written the best and the clearest treatise the world ever saw upon weight or gravitation. It was pub-

lished in the *Penny Cyclopædia*, and he recommended every working man to read it; for, although the subject might appear to be a dry one, he could assure them that it was most fascinating. Eilaw's Mathematical Treatise was also a succinct and admirable work, which would be found of the utmost practical utility to the working mechanic. The first and most important doctrine to remember in mathematics was, that shape is not size, and size is not shape. This might appear to be an axiom, and he thought it was as good as any in Euclid. The doctrine of similar triangles was a fundamental principle entitled to the dignity of an axiom: it was that, without regard to shape and size, any number of triangles might be made all of the same shape and not of the same size. Mr. Russell having illustrated this principle by drawings on the board, continued to say that, with respect to solid geometry, the two great duties in a workman's life were conversion of materials and adaptation to strength. A mason who used up a wrong stone, or a carpenter who selected a wrong plank, or piece of timber, showed that he was ignorant of one of the most useful portions of his art or calling. Now nothing would teach conversion of materials like solid geometry; it was in fact the daily business of the workman. It had been said that every block of marble cut from the quarry contained a beautiful statue, but the art was how to get it out of it. This was very true; for what workmen wanted to know was every shape, and how to get out another shape. The workman who took from a heap a block of stone, or a piece of timber that cost his master 50s. when a piece could be got, answering quite as well, which cost 25s., inflicted a loss upon his employer perhaps equal to a week's wages. Hence the necessity of acquiring a knowledge of solid geometry. But if there were beauty in the quantity of numbers, and in regular geometrical figures, there was infinitely more beauty in curves. It was the duty of many mechanics, especially of those engaged in ship-building, to make curved lines. To him it had always been an interesting subject to learn how curves grew. He was aware that he might be told that the higher curves were never taught, but his answer was that they might easily be taught, and that they were very easy of comprehension. In order to effect this, somebody who understood the subject would have to be prevailed upon, not to write a book, but to put down in the shortest and plainest possible language what he knew of curves. This would be a treatise which the workman could understand, and would be well worth the thousand pounds which he hoped the Government would be prevailed upon to give to one of the four clever men to write. The lecturer then explained, with the aid of the board, the various mathematical figures known as conic sections, parabola, ellipse, hyperbola, and the movement of the comets. These, he contended, might be learned so as to make the workman master of the principle within six months. The subject of the education of the workman was one which he had very much at heart. He did not know how it was to be given, but as the pupil teachers were present as an Institution which took charge of the mechanic, and a Government which was anxious for the spread of education, he would urgently beg of them to take counsel with half-a-dozen of the best mathematicians of the day, and arrange with them to write short treatises, which could be circulated at a cheap rate, and which could be taught in our elementary schools. He also thought that there ought to be a large quantity of apparatus—a sort of inventory of education—of every conceivable shape and object. In addition to these models, he would have the school-room hung round, not with pictures of animals, but with solid bodies, which could be explained and drawn. He would, in fact, impart any kind of practical rather than book knowledge. If drawings merely were used instead of models, he did not think the student could imbibe so correct a notion of the object to be produced or delineated. There was a mode of studying forms called *la théorie de développement*, but the plain English meant nothing more than making flat surfaces into round and angular forms (as models now made from sheets of paper, which was a most valuable mode of studying forms). If this description of education could be given, he would take the pupils educated in that department and give them three guineas a week. He might afterwards raise them to foremen with salaries of £500 a year, and that would be far better than remaining all their lives at the bench, earning 30s. a week. Machinery could now be obtained to do all the unintellectual drudgery of mechanism. He was not opposed to machinery, and had no apprehension that it would supersede skilled intellectual handicraft. He would employ machinery to do all the drudgery that degraded the workman into a beast of burden. He would give him higher views of mathematics; he would show him that he was an intellectual, thinking being, with a soul for high and immortal things.

Mr. Russell concluded by expressing a hope that Government would seriously undertake the education of the working man, so as to enable us to maintain our superiority among the civilised nations of the world.

Home Correspondence.

UNIFORM MUSICAL PITCH.

SIR,—In the account published in your *Journal* of the meeting held at the Society of Arts, on the subject of "Musical Pitch," an omission occurs which I shall feel obliged by your permitting me to supply, in order to show the correctness of what I stated. In speaking of the A mentioned in the French report, I said I presumed it was the A of the tuning fork, and, reckoning according to the data of our mathematicians, the number of vibrations for that note did not agree with those given by the French.

A remark made immediately upon my saying this, is the omission to which I allude. That remark was to the effect that the A of the French report was the octave to the tuning fork; viz., an octave above the second space of the treble clef. It was to this remark that I replied in the words correctly reported in your journal, viz., Taking it as that A, according to our mathematicians it ought only to give about 852 vibrations in a second.

I am, &c.,

HENRY WYLDE, Mus. Doc.

6, Burwood-place, Hyde-park, W., June 21st.

Proceedings of Institutions.

GOSPORT LITERARY INSTITUTION.—The general meeting of the members of this Institution was held on Monday, the 30th of May, Henry D. P. Cunningham, Esq., R.N., the President, in the chair. From the report of the Committee, which was read by Mr. Walter Field, the Secretary, it appeared that the number of members was 165, being an increase of 12 during the past year; that the income of the Institution had been £129 16s. 9d., and the expenditue, £122 19s. 5d.; the balance in hand, including £9 12s. 9d. brought forward, being £16 10s. 1d. It further stated that eleven lectures had been delivered during the session, the receipt on that account being £50 0s. 9d., and the expenses £42 18s. 0d., showing a profit of £7 2s. 9d. Particular allusion was made to the recent union with the Society of Arts, and the many advantages resulting therefrom pointed out. The library, it was remarked, had been increased by the purchase of some new books, and 81 members had taken out volumes, the number of issues being 737. The Report concluded by congratulating the members upon the evident progress made in every department of the Institution. Considerable discussion ensued upon the subject of Mutual Instruction

Classes and the examinations instituted by the Society of Arts, and the proceedings terminated by a vote of thanks being presented to the officers for their services to the Institution.

MEETINGS FOR THE ENSUING WEEK.

MON. .....Geographical, 8½. 1. Mr Alfred R. Wallace, "Notes on a Voyage to New Guinea." 2. Mr. J. Macqueen, "Remarks on Portuguese Journeys across Central Africa." 3. Mr. D. O. King, "Travels in Eastern Siam and Cambodia."
TUES. .....Medical and Chirurg.
Zoological, 9.
WED. .....Society of Arts, 4. Annual General Meeting.
Microscopical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 17th, 1859*]

Dated 21st February, 1859.

474. P. Spence, Pendleton, Lancashire—Imp. in the manufacture of alum, and in the mode of, and apparatus for, condensing or destroying gases arising therefrom.

Dated 11th March. 1859.

626. R. Hellard, Taunton—Imp. in reaping and mowing machines.

Dated 18th March, 1859.

688. R. Clegg, Islington, and R. Fell, Saint Ann's-place, Limehouse, Middlesex—Improved apparatus for obtaining aerated fresh water from salt water.

Dated 22nd March, 1859.

730. T. Manlove, Radford-grove, and W. Hodgkinson, New Lenton, Nottinghamshire—A new method of manufacturing plain, figured, striped, and plaited textile fabrics in imitation of loom-made fabrics.

Dated 5th April 1859.

852. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in open fire places. (A com.)

Dated 15th April, 1859.

946. G. Abeillou, Toulouse, France—An extensible arching plane.

Dated 30th April, 1859.

1082. W. Winstanley and J. Kelly, Liverpool—Imp. in pumps, and gearing and appliances for working the same.

Dated 3rd May, 1859.

1106. T. W. Miller, Portsea—Imp. in apparatus for and mode of generating steam and economising fuel.
1108. W. Sellers, Philadelphia, U.S.—Imp. in couplings for shafting. (Partly a com.)

Dated 10th May, 1859.

1176. W. O. Bourne, New York, U.S.—Imp. in the means of and apparatus for separating metals, ores, and other substances of different specific gravities.

Dated 12th May, 1859.

1194. W. Warne, J. A. Fanshawe, J. A. Jacques, and T. Galpin, Tottenham—An improved compound or preparation of materials for, and mode of, and apparatus for, covering and insulating wires or conductors used for telegraphic or electrical purposes.

Dated 18th May, 1859.

1230. A. R. Terry, 24, Great George-street, Westminster—Imp. in apparatus for sawing and cutting up loaf sugar.

Dated 20th May, 1859.

1244. G. J. Parfitt, Bath—Imp. in gas burners.

Dated 21st May, 1859.

1252. A. L. Taylor, 16, Ludgate-hill—An improved form of harmonican pianoforte.

Dated 23rd May, 1859.

1260. J. H. Brierley, Halifax, and G. Old, Temple-street, Birmingham—A brace buckle.
1262. R. V. Leach, Briton Ferry, Glamorgan, and T. W. Willett, Pont-Neath-Vaughan, Brecon—Imp. in the manufacture of tin plates and terne or leaded plates, and in the apparatus connected therewith.
1264. G. Burnell, East Hoathly, Sussex—An improved preparation or medicine for the cure of ague.
1266. H. A. Cooke, Chancery-lane—Imp. in omnibuses.
1268. C. P. Moody, Corton Denham, Somersetshire—Imp. in machinery for the manufacture of matting or fabric from straw and other vegetable fibres, and reds or bars of wood and metal.
1270. F. J. Bramwell, Great George-street, Westminster—Imp. in apparatus for raising ships and vessels out of the water (Partly a com.)
1272. N. S. Dodge, 44, St. Paul's Churchyard—Imp. in treating waste vulcanized india rubber. (A com.)
1274. N. S. Dodge, St. Paul's Churchyard—Imp. in finishing, colouring, and varnishing india rubber goods, and similar manufactures. (A com.)

Dated 24th May, 1859.

1276. J. Stansfield, Batley, Yorkshire—Imp. in the permanent way of railways.
1278. J. C. Fisher, 51, Catherine-street, Glasgow—Imp. in preparing paints and varnishes.
1280. J. Gibbs, Bromford, Middlesex—A method of treating coal, shale, lignites, and peat, in order to manufacture manure.
1282. G. Hadfield, Carlisle—An improved arrangement of heating and evaporating apparatus.
1284. A. J. Sax, Paris—Imp. in wind musical instruments.

Dated 25th May, 1859.

1288. D. S. Price, 7, Green-street, Grosvenor square, Middlesex—Imp. in the production of colours for dyeing and printing.
1290. E. Maw, Doncaster Ironworks, Yorkshire—Imp. in the construction of metallic bedsteads and other furniture.
1292. A. Prince, 4, Trafalgar-square, Charing cross—Imp. in screw propellors. (A com.)
1294. J. Millet, Barnstaple, Devon—An improved regulator for watches, portable clocks, and timepieces.
1296. J. Howard, Bedford—An improved construction of horse-rake.

Dated 26th May, 1859.

1298. J. Webster, Birmingham—An imp. or imps. in pressure and vacuum guages.
1299. J. Reynolds, 11, Carthusian street, Charterhouse-square—Imp. in propelling vessels.
1310. H. W. Patrick, 4, Mill-hill-terrace, Acton—A new substance or material to be used in lieu of ivory and other like substances.
1301. C. Dorn, Birmingham—Imp. in kilns for baking or burning China earthenware and bricks, and for other like purposes.
1302. J. Young, Wolverhampton—Imp. in locks, and in the manufacture of knobs for locks and latches, and also in apparatus for preventing draughts and keeping out wet from doors and windows.
1303. P. Ellertz, Manchester—Certain imp in machinery or apparatus for cutting paper, pasteboard, cardboard, and also for cutting or slicing wood into thin scaleboard or veneers, or for similarly cutting other articles.
1304. G. F. Chantrell, Liverpool—Imp. in the construction of charcoal kilns, and in the manufacture of coolers for charcoal kilns.
1305. W. H. Nevill, Llanelly, Carmarthenshire—Imp. in the manufacture of steel and wrought iron.
1306. J. Draper, 5, Little Tower-street—Imp. in applying indices to account and other books.
1307. M. Michaelis, Manchester, and R. Kershaw, Heywood—Imp. in the manufacture of velvets and other piled fabrics.
1308. J. C. Bent, Birmingham—Imp. in gas meters.
1309. W. Wright, Deptford—Imp. in fastening shirts, collars, and other articles of wearing apparel.

Dated 27th May, 1859.

1311. W. Weild, Manchester—Imp. in looms for weaving pile fabrics.
1312. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved mode of advertising. (A com.)
1313 P. Aitchison and T. Binks, Sheffield—Imp. in self-acting and other water closets, and in flushing apparatus connected therewith.
1314. L. Farrenc and B. Subra, Paris—Imp. in gas lighting by means of direct carburators.
1315. H. N. Nissen, Mark-lane—An imp. in book indexes.
1316. G. Hadfield, Carlisle—Imp. in the mode of and apparatus for forming casks or barrels.

Dated 28th May, 1859.

1317. B. Samuelson, Banbury—Imp. in machines for cutting roots and other vegetables.
1318. T. Wilson, Birmingham—Imp. in breech-loading fire-arms and ordnance.
1319. W. Crum, Thornliebank, Renfrew—Imp. in printing and dyeing textile fibres and fabrics.
1320. W. A. Gravely, Upper East Smithfield—Imp. in apparatuses for purifying and aerating sea water, parts of which may be employed for cooking and baking purposes.
1321. R. A. Brooman, 166, Fleet-street—Imp. in machinery for cleaning, grinding, and bolting corn and other grain. (A com.)
1322 J. Oldbury, Summer row, Handsworth, Staffordshire—Imp. in breech-loading fire-arms, applicable to pistols, muskets, carbines, and birding or other guns.
1323. J. Bapty, Leeds—An improved mode of, and apparatus for, manufacturing felted cloth.

Dated 30th May, 1859.

1321. M. Davis, 5, Lyon's-inn, Strand—Imp. in the construction of wheels, axles, and boxes for carriages.
1325. A. Smith, 69, Princes-street, Leicester-square—Imp. in machinery for making lines, ropes, and cables, for telegraphic and other purposes.
1326. W. Grimshaw, Bowdon, Chester—Certain imp. in machinery for compressing bricks, tiles, artificial fuel, and other similar articles.
1327. E. Breffit, 61, King William-street—Imp. in machinery or apparatus for the manufacture of hollow corks.
1328. J. Bruce, Tiddington, near Stratford-on-Avon, Warwickshire—An imp. in agricultural drills.
1329. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of iron and steel.

1330. J. Fry, Wrotham, Sevenoaks, Kent—An imp. in mills for grinding.
1331. O. Maggs, Bourton, Dorsetshire—Imp. in harrows.
1332. W. Green, Victoria Works, Dod-street, Limehouse—Imp. in washing or purifying and treating sugar.
1333. I. Blackburn and R. Blackburn, Long Eaton, Derbyshire—Imp. in locomotive and traction engines, and in implements connected therewith for cultivating the soil.
1334. J. L. Norton, Belle Sauvage-yard, Ludgate-hill—Imp. in machines for stretching and drying fabrics, and in drying wool and other fibres.
1335. A. Micklethwaite, J. Peace, and S. J. Hobson, Sheffield—Imp. in the coating and covering of metallic springs, steel, iron, and other metal bands for the use of any kind of machinery, driving bands, or straps, ribs suitable for umbrellas and parasols, staybusks, and ribs for stays, hats, bonnets, reeds, and crinoline, and articles of dress, and other useful purposes.
1336. E. Leeson, 13, Traffic-street, Derby—Imp. in machinery for the manufacture of ornamental chenille fringes and braids or other fabrics.
1337. W. Clark, 53, Chancery-lane—Certain improved means of reefing and shortening sail in ships and other vessels. (A com.)
1338. W. Clark, 53, Chancery lane—A new manufacture of leaven. (A com.)

Dated 31st May, 1859.

1340. J. S. Cockings, Ann-street, Birmingham—Certain imp. in the construction of self-adjusting cases for holding and carrying cartridges of various sizes or guages, parts of which imps. are also applicable to cartridge-carriers now in use.
1341. S. Carr and G. Butterworth, Leeds—Imp. in the manufacture of felted cloth, and in the machinery or apparatus employed in such manufacture.
1342. E. A. Wood, Victoria-terrace, Notting-hill, and D. Rogers, Bromley, Middlesex—Improved apparatus for raising and lowering boats.
1343. J. Wansbrough, Bridge-street, Southwark—Imp. in the construction of stereoscopes. (A com.)
1344. G. H. Smith, Manchester—Imp. in sewing machines.
1345. P. Gambardella, 123, Chancery-lane—Imp. in obtaining motive power, and in machinery or apparatus connected therewith.
1346. J. J. Lundy, Manchester—Imp. in cartridges and gun-wads, for facilitating the loading and lubricating of fire-arms.
1347. A. Suter, 65, Fenchurch-street—A furniture castor, to be used upon the feet of tables, seats, and all descriptions of furniture or other things.
1348. F. Roberts, Maiden Newton, and A. Roberts, Frome, Vanchurch, Dorsetshire—Imp. in apparatus employed for ploughing, tilling, or cultivating land, when steam power is employed.

Dated 1st June, 1859.

1349. J. F. Miquel, Paris—Imp. in trusses.

Dated 2nd June, 1859.

1351. F. W. Saltonstall, Northumberland street, Strand, and A. Bush, Hanover-cottage, Park-road, St. John's-wood—An improved machine or apparatus for dredging and excavating
1352. M. H. Chapin, 4, Gresham-street—Imp. in galloons, tapes, or ribbons, for supporting steel and other hoops used for distending ladies' dresses.
1353. R. K. Whitehead, Elton, near Bury, Lancashire—Imp. in apparatus to be used in bleaching, dyeing, and extracting the colouring matter from dye materials.
1354. S. Wood and J. Wood, Manchester, and P. Billington, Rusholme, near Manchester—Certain imp. in and applicable to machines for embroidering.
1355. A. Smith and W. Smith, Glassow—Imp. in machinery for curing sugar, and for separating solid and liquid substances by centrifugal force.
1356. S. Bury, Manchester—Certain imp. in machinery or apparatus for embossing and finishing textile fabrics or other like surfaces.
1357. S. Bury, Manchester—Certain imp. in machinery or apparatus for embossing and finishing textile fabrics or other like surfaces.
1358. W. H. Parkes and W. Bagnall, Birmingham—A new or improved ventilator for hats and other head coverings, and also for carriages.
1359. T. Whitby, Millbank-street, and W. Dempsey, Great George-street, Westminster—Imp. in and applicable to ordnance and firearms, and in the projectiles to be used therewith.
1360. J. B. Pascal, Paris—Imp. in hot-air engines.

Dated 3rd June, 1859.

1361. J. Wilson, St. Helens, Lancashire—Imp. in the manufacture of carbonate of soda.
1362. J. Edwards, 77, Aldermanbury—Imp. in the manufactures of anchors.
1363. R. W. Sievier, Upper Holloway—Imp. in smelting and purifying of iron and other ores.
1364. J. Onions, Darlaston, Staffordshire—A new or improved steam boiler.
1365. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of iron and steel.
1366. H. N. Penrice, Witton-house, near Norwich—Imp. in machinery for propelling vessels.
1367. J. Kyle, Liverpool—Imp. in points for railways and chairs for the same.
1368. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in reducing solid substances to powder, and in the machinery or apparatus employed therein. (A com.)
1369. J. J. Baranowski, Paris—Imp. in railway signal apparatuses.
1370. A. R. Arrott, St. Helen's, Lancashire—Imp. in the manufacture of soda.
1371. Rev. J. Burrow, Ashford Parsonage, Bakewell, Derbyshire, and W. N. Wilson, 144, High Holborn—An improved floor scrubber and sweeper for carpets, lawns, and other such like useful purposes.
1372. A. V. Newton, 66, Chancery-lane—An imp. in balancing millstones. (A com.)

Dated 4th June, 1859.

1373. H. Crossley, Nailsworth, near Manchester—Imp. in Jacquard machines.
1374. R. Chrimes, Rotherham, Yorkshire—Imp. in apparatus for supplying water to, and discharging the contents from, urinals, wash-hand basins, and other similar articles.
1375. E. Gill, the Elms, St. Ann's-road, Wandsworth-common—Imp. in producing spirit from rice, maize, and other descriptions of grain.
1376. J. Nuttall, Old Accrington, G. Riding, Clayton-le-Moors, and W. Coulthurst, Old Accrington, Lancashire—An improved size powder, to be used in sizing cotton, linen, or other warps for weaving.
1377. G. Davies, 1, Serle-street, Lincoln's-inn—An imp in wearing apparel. (A com.)
1378. J. Wood and W. Wood, Nottingham—A peculiar mode or method of dyeing lace or other fabrics, and making the same into bonnet and cap fronts, or other articles.
1379. C. James, Mountain Ash, Aberdare, Glamorganshire—An imp. in the manufacture of railway chairs.

Dated 6th June, 1859.

1382. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in paddle-wheels and screw-propellers for steam-vessels. (A com.)
1384. W. Green, 2, Victoria-street, London—Imp. in mowing machines.

Dated 7th June, 1859.

1386. K. H. Cornish, 5, Essex-court, Middle Temple—Imp. in bedsteads, sofas, couches, and chairs, applicable to other seats or reclining surfaces.
1388. W. B. Nation, Union-row, Union-bridge, Rotherhithe—Imp. in the manufacture of superphosphate of lime.
1390. R. Barclay, Bucklersbury—Imp. in the manufacture of paper from which writing or other inks cannot be expunged or extracted without detection.
1392. R. R. Fairgrieve, Boston, U.S., and S. Bathgate, Selkirk, N.B.—Imp. in machinery or apparatus for winding yarns or thread.

Dated 8th June, 1859.

1394. J. Henderson, W. Henderson, T. Bagley, and S. Holdsworth, Durham—Imp. in looms for weaving, some of which improvements are applicable to other purposes.
1396. J. B. Howell, Sheffield, J. Hick and W. Hargreaves, Great Bolton, Lancashire—Imp. in apparatus for applying heat to steam or other boilers or vessels, and for facilitating the combustion of gases and smoke.
1398. J. B. Molozay, 68, Rue d'Angouleme du Temple, Paris—New means of manufacturing velvet.
1400. A. V. Newton, 66, Chancery-lane—Imp. in gas meters. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, June 17th*, 1859.]

June 17th.

2900. J. Mackenzie.
2902. J. Taylor.
2908. S. Hunter.
2910. J. Ronald.
2914. W. E. Dando.
2924. M. Kenney.
2933. J. Ronald.
2958. W. A. Gilbee.
2861. C. M. A. Marion.
2997. J. W. Duncan.
40. R. Rumney and W. S. Macdonald.
30. J. Furnival, T. Furnival, J. Derbyshire, and F. J. Emery.
82. B. Bobbin.
100. R. Mushet.
132. R. Mushet.
134. R. Mushet.
234. W. E. Newton.
310. H. C. Jennings.
860. I. Adams.
988. A. W. Williamson.
1110. J. Morse.

[*From Gazette, June 21st*, 1859.]

June 21st.

2917. W. S. Yates.
2921. R. Clegg, F. Angerstein, and G. Ferry.
2926. E. T. Dunn.
2930. A. Prince.
2942. J. W. Child.
2954. J. Radley,
2966. J. Sinclair.
12. Pierre Emmanuel Guerinot.
37. F. Clark.
39. J. Howard.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, June 17th*, 1859.]

June 13th.

1418. E. Guerin.

June 14th.

1336. W. Smith.

June 15th.

1453, J. Bullough.

[*From Gazette, June 21st*, 1859.]

June 16th.

1436. W. H. Tucker.
1437. M. A. Muir and J. M'Ilwham.
1438. C. Clifford.
1441. G. Tillett.
1473. H. H. Vivian, B. G. Herrmann, and W. Morgan.
1475. I. Atkin and M. Miller.

June 17th.

1479. J. Saxby.

June 18th.

1934. P. Noyer.